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㉝発明の名称　車両用ヒートポンプ式冷暖房装置

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１．発明の名称

車両用ヒートポンプ式冷暖房装置

２．特許請求の範囲

1)エンジンの冷却水を熱源とする温水ヒータ式暖房装置と併用され、暖房サイクル時にはエンジン冷却水を熱源として利用する型式のヒートポンプ式冷暖房装置において、

内外気の導入口と温風吹出口との間に順次、前記ヒートポンプ式冷暖房装置用の第１熱交換器と、前記温水ヒータ式暖房装置用の第２熱交換器と、該第２熱交換器の熱交換能力の制御手段と、送風用ファンとを内蔵させた冷温風発生用ダクトと、前記温風吹出口から吹き出される空気温度を検出する空気温センサと、該センサにより検出した前記吹き出し空気温度と設定空調温度とを比較して前記ヒートポンプの駆動用コンプレッサの作動を制御する回路とを備えたことを特徴とする車両用ヒートポンプ式冷暖房装置。

2)前記設定空調温度が、前記第２熱交換器の制御手段の変位用操作レバーに付設された可変抵抗器を介して調節されることを特徴とする特許請求の範囲第１項記載の車両用ヒートポンプ式冷暖房装置。

３．発明の詳細な説明

［産業上の利用分野］

本発明はエンジン冷却水を熱源とする温水ヒータ式暖房装置と組合せて使用される車両用ヒートポンプ式冷暖房装置に関する。

［従来の技術］

エンジンの冷却温水を熱源とする在来の自動車用温水式ヒータは暖房性能の面でいくつかの難点を抱えていた。その第１は外気温の低い時にはエンジン始動後、ラジエータ内の冷却水が昇温するまでに時間がかかり、いわゆる即効暖房能力に欠ける点であり、第２には燃料の燃焼効率の高いデ

ィーゼル エンジン車あるいは最近の高回転ガソリンエンジン車の場合には、エンジン冷却水温が暖房用エネルギーをまかなうに足りる程には昇温し難いことであった。ことに寒冷地域においてはこのような暖房能力不足が大きな問題となる。対応策として、車室内冷房用装置の冷凍サイクルを逆向きに動かせてヒートポンプとして作動させ、外気温を取り込む方式のヒートポンプ式冷暖房装置の採用が考えられたが、この装置はいわゆる即効暖房性能を高めるための有力手段としては役立つものの、満足すべき暖房感を得るためには外気温が0℃以上であることが望ましいとされており、寒冷地域では温水ヒータの能力不足を補う存在とはなりえない。

そこで本発明者らは即効暖房性能に加えて暖房能力そのものの高められた新規のヒートポンプ式冷暖房装置を先に提案した。

第7図は上記装置の冷房および暖房サイクル図であって冷媒圧縮器1、車室外熱交換器5、冷房用減圧装置8、車室内熱交換器2、レシーバ9および上記の諸要素を図示のように連結する冷媒管路aよりなる冷凍装置に、暖房時の吸熱源としてエンジンAの冷却水（温水）を用い且つ暖房用減圧装置10を上流側に有する熱交換器4を設け、さらに冷房運転時と暖房運転時とで圧縮器1から吐出される冷媒の流れを逆にすべく前記冷媒流路管aには、四方弁17と、冷房運転時に熱交換器4への冷媒の供給を停止する開閉装置である電磁弁13と、暖房運転時に車室外熱交換器5への冷媒の供給を阻止する逆止弁14と、冷房運転時に冷媒が冷房用減圧装置8を介さず（レシーバ9を介さず）に車室内熱交換器2に流入するのを防止する逆止弁15と、暖房運転時に熱交換器4を通過した冷媒が四方弁17に流入するのを防ぐ逆止弁16とを設けた冷暖房サイクルである。この冷暖房サイクルの作動を次に説明する。

イ）冷房運転時

四方弁17は第7図に実線で示したように冷媒流路管aと連結し、冷媒は実線矢印の方向に流れる。冷媒圧縮器1で圧縮されて吐出した冷媒は四方弁17により導かれて、冷房時には空冷式の冷媒凝縮器として働く車室外熱交換器5に入り、ここで冷媒が凝縮される。凝縮された冷媒は逆止弁14を通過したのち、逆止弁15により阻止され、レシーバ9内に流入する。レシーバ9内で冷媒は気相冷媒と液相冷媒とに分離され、液相冷媒のみがレシーバ9により吐出される。吐出された液相冷媒は電磁弁13が閉じられているため、冷房減圧装置8で断熱膨脹され低温冷媒となり、冷媒蒸発器である車室内熱交換器2に入り、ここで低温冷媒は熱を吸収して蒸発し、次に、四方弁17を通り、逆止弁16を通過して再び冷媒圧縮器1に吸入される。上記サイクルを繰り返すことにより車室内が冷房される。このとき熱交換器4の温度は、圧縮器1へ流入する冷媒温度より高く且つ圧力も高いため、熱交換器4内の冷媒は下流の冷媒流路管aを通って圧縮器1の方へ流出し、内部は気相冷媒のみとなる。

ロ）暖房運転時

四方弁17は第7図で破線で示したように冷媒流路管aと連結し、冷媒は破線矢印の方向に流れる。冷媒圧縮器1で圧縮されて吐出した冷媒は四方弁17により導かれて、暖房時には空冷式の冷媒凝縮器として働く車室内熱交換器2に入り、車室内空気を加熱して、冷媒が凝縮される。凝縮された冷媒は逆止弁15を通過したのち逆止弁14に阻止され、レシーバ9に流入する（このとき冷房用減圧装置8は一般に閉じる構造となっている）。レシーバ9より吐出された液相冷媒は、電磁弁13が開かれているため、暖房用減圧装置10で減圧され熱交換器4に入る。ここで冷媒はエンジンAから循環用配管bを介して冷却水（温水）を受ける冷却水槽4a内の温水の熱を吸収して蒸発し、再び冷媒圧縮器1に吸入され、ここで圧縮されて高温となって四方弁17の方へ吐出され、上記サイクルを繰り返すことにより車室内が暖房される。

[発明が解決しようとする問題点]

本発明は、上述の如きエンジン冷却温水を熱源として利用する方式の暖房性能の勝れたヒートポンプ式冷暖房装置の難点である駆動エネルギーの消費を極力抑えるために、この装置を在来の温水ヒータ式暖房装置と組合せて使用することとし、後者の暖房能力に不足をきたした時に限って前者の装置を自動的に働かせることのできる改良された車両用ヒートポンプ式冷暖房装置を提供することを目的とする。

[問題点を解決するための手段]

上記の目的を達成するために本発明の車両用ヒートポンプ式冷暖房装置は、エンジンの冷却水を熱源とする温水ヒータ式暖房装置と併用され、暖房サイクル時にはエンジン冷却水を熱源として利用する型式のヒートポンプ式冷暖房装置において、内外気の導入口と温風吹出口との間に順次、前記ヒートポンプ式冷暖房装置用の第1熱交換器と、前記温水ヒータ式暖房装置用の第2熱交換器と、該第2熱交換器の熱交換能力の制御手段と、送風用ファンとを内蔵させた冷温風発生用ダクトと、前記温風吹出口から吹き出される空気温度を検出する空気温センサと、該センサにより検出した前記吹き出し空気温度と設定空調温度とを比較して前記ヒートポンプの駆動用コンプレッサの作動を制御する回路とを付設する構成を採用した。

[作用]

上記の構成を備えた本発明の車両用ヒートポンプ式冷暖房装置は、暖房運転時において、装置の温風吹出口に設けられている空気温センサが、温度制御手段を介して調節可能な設定空調温度より低い温度を検知した時に限って、前記温水ヒータ式暖房装置の暖房能力不足を補うべくヒートポンプ式冷暖房装置を稼動する。ヒートポンプの始動と停止は、装置のコントロールアンプ内に組込まれている、上記両温度の比較回路によって判断された結果に基づいて、ヒートポンプ駆動用コンプレッサを作動させる制御回路を通じて行われる。

[実施例]

本発明の車両用ヒートポンプ式冷暖房装置を付図に示す実施例に基づいて以下に説明する。

第1図は装置の作動サイクル図であって、サイクルを構成する各要素とその配置状況は基本的には前述の第7図に示されたそれと全く共通しているが、ただエンジンAのウォータージャケットと、熱交換器4 とを結ぶ冷却水の循環用配管bおよびcの間に熱交換器4 と並列する如くに、温水ヒートサイクル用の第2熱交換器3 が介在されていることと、この第2熱交換器3 の上流側に熱交換器3 への温水の供給を断続させるための電磁弁11が設けられている点が相違する。また好ましくは、熱交換器4 の上流側にもエンジン冷却水の流入断続用バルブ12を設けるのがよい。この図の中の他の符号はいずれも前述の第7図に示されたそれと共通している。18および19は感熱筒である。

第2図は、本発明装置の冷温風発生用ダクトの模式的側断面図を含む装置の作動回路図であって、50は温風発生用ダクト、51は車室内外気の導入口、52は温風吹出口、53は送風機、2 はヒートポンプサイクル用の第1熱交換器、 3は温水ヒートサイクル用の第2熱交換器としての温水ヒータ、54は第2熱交換器3 をバイパスさせるための通気路、55は第2熱交換器3 の上流側またはバイパス通気路54のいずれかを選択的に封鎖するかないしはこの両状態の中間状態を選択的に採りうる第2熱交換器 3の熱交換能力の制御手段としてのエアミックスダンパであり、このダンパ55に代る制御手段として、第2熱交換器3 への温水流入量の調節用にこの流路に介在させた遠隔操作バルブであっても良い。56は温風吹出口52の空気温センサである。

bおよびcは第3熱交換器としてのラジエータ4 にエンジン冷却温水を供給するための循環用配管であり、その往路には電磁弁11とバルブ12とが介在されている。59はエンジン冷却水温センサ、60は電磁弁11の開閉制御用回路、61は圧縮器1 へのエンジン回転力断続用のマグネットクラッチ62

のオン～オフ制御回路である。

次に上記装置の作動について、エアミックスダンパ55が温風発生用ダクト50内のバイパス通気路54を完全に封鎖し最強暖房状態にある場合について説明すると、

今エンジン冷却水温Twが充分に高いとすれば、温風吹出口52によって検知される温風発生用ダクト50の出口温度T3は温水ヒータ3の使用のみで所望の設定空調温度Toに到達させることができる。温度Toの吹出空気温を得るために必要なエンジン冷却水温をTwoとすれば、温水ヒータ3の温度効率をφ、ダクト50に導入される空気温度をT1として、T3＝To＝φ(Two－T1)+T1の関係式が成り立つので、Two＝1/φ(To－T1)+T1＝To+(1－φ)(To－T1)/φとなり、必要とするエンジン冷却水温Twoは、ToよりΔT〔＝(1－φ)(To－T1)/φ＞0〕だけ高くなければならないことがわかる。例えばφ＝0.7、T1＝－20℃、To＝50℃の条件設定を行なった場合には、Two＝80℃、ΔT＝30℃となる。

ところで温水ヒータ3へのエンジン冷却温水の供給断続用の電磁弁11は、開閉制御用回路60によってTw＞Toのとき開弁し、Tw≦Toのとき閉じられる。また圧縮器1の駆動断続用のマグネットクラッチ62は、オン～オフ制御回路61によってT3≦Toのときオン作動し、T3＞Toのときオフされるようにセットされている。設定空調温度Toは後述するように調節用レバーの操作によって自由に変えることができる。そこで、Tw≧Twoであれば、当然電磁弁11の開弁条件Tw＞Toの関係が成り立つので、温水ヒートサイクルが稼動する。しかも温度T1の外気がヒートポンプ用熱交換器2で加温されることなく温水ヒータ3に通入されても吹出温度T3は、T3＞Toの条件下におかれるので、マグネットクラッチ62はオン作動せず、ヒートポンプサイクルが働くことはない。

つぎにTw＜Twoつまり温水ヒータの暖房能力が不足している場合には、外気が外気温T1のままで温水ヒータ3に流入すると、T3＞Toの条件がみたされないので、開閉制御用路60がマグネットクラッチ62をオン作動させヒートポンプサイクルが始動する。その場合、Twが約30℃以下とかなり低くない限り、ヒートポンプサイクルのみによってT3＞Toの条件を維持することは可能であるが、Tw＞Toの状態が保たれる限り、電磁弁11は開弁されており、温水ヒートサイクルも機能する。このようになる理由は、Two＞Tw＞Toの状態下では、ヒートポンプ用熱交換器2の下流側空気温度T2がToより低い温度のT´oであっても、T3はToに達することができるためで、To＝φ(Tw－T´o)+T´oの関係より、例えばTo＝50℃、φ＝0.7のときTw＝65℃(＞To、＜Two)ならば、T´o＝15℃で足りる。TwがTwoに近いほどT´oは低い温度でよく、T2＞T´oとなると、T3＞Toの状態が生じてオン～オフ制御回路61はマグネットクラッチ62をオフさせるので結局のところヒートポンプはT2＝T´oの条件が満されるように、したがってT3＝Toつまり吹出口52の空気温度が設定空調温度に等しくなるようにオン～オフ制御されることとなり、圧縮器1の駆動用エネルギーを消費するヒートポンプサイクルの稼動を必要最小限にとどめることが可能となる。

しかしエンジン冷却水温Twがさらに低下して設定空調温度Toを下回ると、開閉制御用回路60からの指示に基づいて電磁弁11が閉じられ、加温されるべき空気が温水ヒータ3を通過する際に、あべこべに温熱を温水ヒータ3によって吸収されてしまう不都合をまぬがれることができる。もっとも、この電磁弁を操作した当座は温水ヒータ3自身の熱容量に基づく幾分かの不合理な熱授受は行なわれる。

なお熱交換器4と温水ヒートサイクル用の温水ヒータ3とを結ぶ温水配管の途中にバルブ12を設

けた理由は、ヒートポンプサイクルのオフ時にバルブ12を閉じることによって、第１熱交換器2 への温水流入量が増大し温度効率φが高まるために、Ｔｗｏは比較的低い値で足りることとなり、ヒートポンプサイクルの稼動率がその分だけ低下する効果をねらったものであって、必ずしも設ける必要はない。

つぎに吹出空気温度の調節用エアミックスダンパ55の位置が最強暖房（ＭＡＸ　ＨＯＴ）以外の位置に設定されている場合についての説明に移る。温風発生用ダクト50の内外気導入口51から吸入され、第１熱交換器2 を通過した空気は、下流の第２の熱交換器としての温水ヒータ3 との間に介在させたエアミックスダンパ55を図の矢印に示され範囲の任意の位置まで回動させることによってその全量を温水ヒータ3 に通入させることも、またその全量をバイパス通気路54側にバイパスさせることも、あるいは一部の空気だけをバイパス通気路に流入させることもできる。今、ダンパ55がこの中間位置をとっている場合を考えれば、第１熱交換器2 を通過した空気の一部は温水ヒータ3 をバイパスして暖められないままに吹出口52に向かうので、ダンパ55がＭＡＸ　ＨＯＴ位置にあるときに較べて温水ヒータ3 による加熱量が減少する。このような状態下で、ダンパがＭＡＸ　ＨＯＴ位置を占めていた時と同等の吹出空気温度を得たいのであれば、エンジン冷却水温ＴｗはＴｗｏと同等以上にあるという条件を満している必要がある。この条件に満たず、ヒートポンプと温水ヒータが併用される場合には、温水ヒータ3 の能力が減殺されている分だけヒートポンプがこれを補い、吹出口温度が設定空調温度にまで高められるように制御が行なわれる。したがって所望の温暖感を得るのに不都合をきたすことはないが、ヒートサイクルの稼動率をいたずらに上昇させる不利を招くことになる。もっともヒートポンプの補助を必要とする程気温が低い時であれば車両の乗員はエアミックスダンパ55をＭＡＸ　ＨＯＴあるいはその近くにセットするのが一般である。

第３図は第２図に示された第１実施例を改良した第２実施例図であって、上記のごときエアミックスダンパ55がＭＡＸ　ＨＯＴ以外の位置にセットされた時の不経済運転の不利を排除するための機能が組込まれている。すなわち、エアミックスダンパ55を変位させるための負圧アクチュエータ63の操作用の３ポート電磁弁64を、制御回路65に入力されるエンジン冷却水温センサ59からの情報に基づいて、Ｔｏ＞Ｔｗｏの状態下ではエアミックスダンパ55をＭＡＸ　ＣＯＯＬ側に、またＴｏ≦Ｔｗの状態下ではＭＡＸ　ＨＯＴ側に働くように回路設定すればよい。この場合、エアミックスダンパ55は温水ヒータ3 での熱交換の有無の制御も自動的に行なうことになるので、電磁弁11は不用となる。もっとも、既述の第７図によって示された暖房サイクルにおいて、温水ヒータ3 を働かせない時には、第３熱交換器4 に温水ヒータ3 への通水分を回し、ヒートポンプ機能を向上させることを考える場合には電磁弁11は有用な存在となる。

上記の実施例において、温水ヒータサイクル単用状態のもとでは、吹出空気温度Ｔ3 が設定空調温度Ｔｏを超えることが起り得る。このような場合に人手によってエアミックスダンパ55のつまみをいちいち微調整する事のわずらわしさを省くための機構を組込むこともでき、この機構はヒートポンプサイクル単用あるいは温水ヒータとヒートポンプ併用の場合にも有効に機能する。

第４図は、本発明装置の作動モードの如何にかかわらず、設定空調温度Ｔｏを常にほぼ一定に維持させるための上記機構を第３の実施例として示した構成説明図であって、70はエアミックスダンパ55の操作用レバー、71はレバーの回転軸、72はレバーのつまみであり、レバー70には、電気接点73が取付けられており、レバーの回転軸の回りに円弧状をなして設置されている可変抵抗器74に接触摺動する。75はレバー位置の表示パネルである。

抵抗器74の両端子部は空気温センサ56とマグネットクラッチ62のオン〜オフ用制御回路61にそれぞれ接続されている。

可変抵抗器74は設定空調温度Toを任意に変化させる役目を帯びており、その抵抗値を変動させるためのレバー70の位置と設定空調温度との関係は、基準となる外気温とエンジン冷却水温のもとで、あるレバー位置したがってエアミックスダンパ位置をセットし、温水ヒータ3 のみを働かせた場合に得られる吹出空気温度をそのセット位置における設定空調温度と定めることとする。

このような機構を付設することによって、ヒートポンプ作動時以外の装置作動モードの場合にも常に吹出口空気温度を設定空調温度Toに保つことができる。ただし、外気温とエンジン冷却水温が上述の基準値を離れるにしたがって、温水ヒートサイクル単用の場合には、吹出温度と設定温度の間にずれを生じてくるが、実用上問題となるほどの隔りとはならない。

つぎに第5図に示された第4実施例においては、温水ヒータ3 への温水の供給断続用電磁弁11の開閉をエンジン冷却水温の変動のみに基づいて行なうのではなくて、第1熱交換器2 の下流の空気温T2 とエンジン冷却水温Twとを比較して、Tw>T2 のとき電磁弁11を開側に、Tw≦T2 の時閉側に動かせる方法がとられている。67は下流側空気温度T2 の検知用センサ、66は検知用センサ67およびエンジン冷却水温センサ59からの情報に基づいて電磁弁11を開閉する制御回路である。

ヒートポンプの型式が既述の第7図に示されたごとき、エンジン冷却水を熱源として利用し、エンジン始動時等の即効暖房能力においても、また平常走行時の暖房能力においても、従来のエンジン冷却水温のみに依存する暖房方式に勝る場合には、上述の制御方法は第1実施例における設定空調温度Toとエンジン冷却水温Twとの比較方法と結果的には変わらないことになる。何故ならエンジン冷却水温Twが設定空調温度Toに到達するまでは、冷媒凝縮器としての第1熱交換器2 の下流側空気温度T2 はTwより高温であるために、T2 がToと同等となった時はじめて圧縮器1 の駆動断続用マグネットクラッチ62がオン〜オフ作動し、T2 がToの温度に保たれ、TwがT2 、したがってToを上回るようになるからである。

一方、ヒートポンプが外気の保有熱を熱源とする型式のものであれば平常運転時の暖房能力は従来の温水単用暖房方式に劣るのが一般である。

しかしエンジン始動時などの暖房機能の立ち上がり過程において勝っており、このような装置ではT2 がTo以下の状態のもとでTw>T2 となることがあり、この時点から温水ヒータを利用できる第4実施例がより望ましいこととなる。

第6図は本発明装置の第5実施例の説明図であって、上記の第4の実施例の思想を既述の第2実施例の具体策を借用することによって現実化させている。

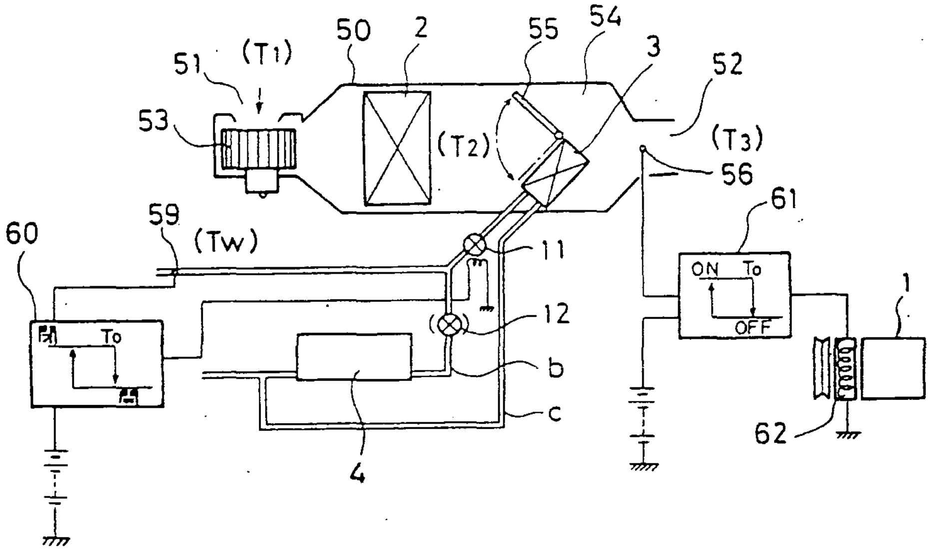
63はエアミックスダンパ55の回動用負圧アクチュエータ、64は負圧アクチュエータ63に負圧または大気圧を切換え供給するための3ポート電磁弁、68はこの3ポート電磁弁64をエンジン冷却水温センサ59および第1熱交換器2 の下流側空気温度センサ67からの情報に基づいて制御するための電子回路である。

その作動はエンジン冷却水温Twが第1熱交換器2 の下流側空気温T2 を上回りTw>T2 となった時、電子回路68の指示に基づいて3ポート電磁弁64の働きを介して負圧アクチュエータ63がエアミックスダンパ55を温水ヒータ3 の上流側を解放させる側に回動させ、Tw≦T2 となった時閉鎖側に移動させる。なお負圧アクチュエータ63には温水ヒータ3 への温水供給断続手段が公知技術によって組込まれる。

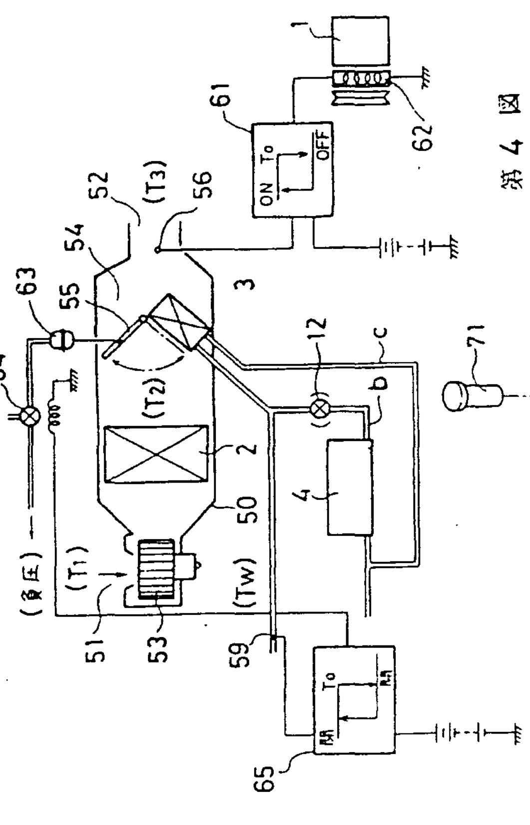
［発明の効果］

本発明の車両用ヒートポンプ式冷暖房装置は、エンジンの過熱防止用冷却水の保有熱のみを熱源として活用する、いわばエネルギー非消費タイプ

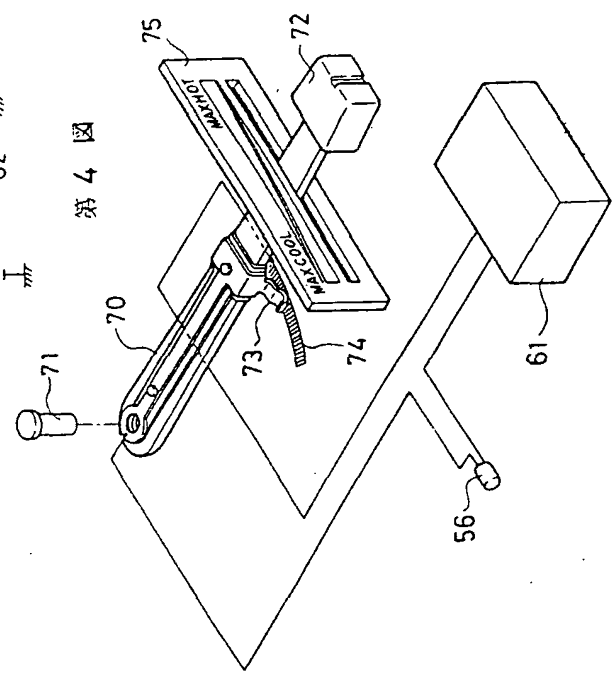
第 2 図


50
2
55
54
3
52
51
(T1)
53
(T2)
(T3)
56
61
ON
To
OFF
1
62
60
59
(Tw)
11
12
b
c
4

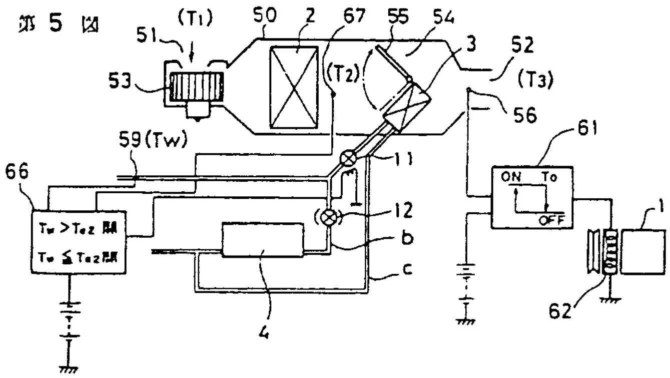
第 3 図


64
63
55
54
52
(T3)
56
61
ON
To
OFF
1
62
3
12
c
b
(T2)
2
50
4
(負圧)
(T1)
(Tw)
51
53
59
65
To

第 4 図

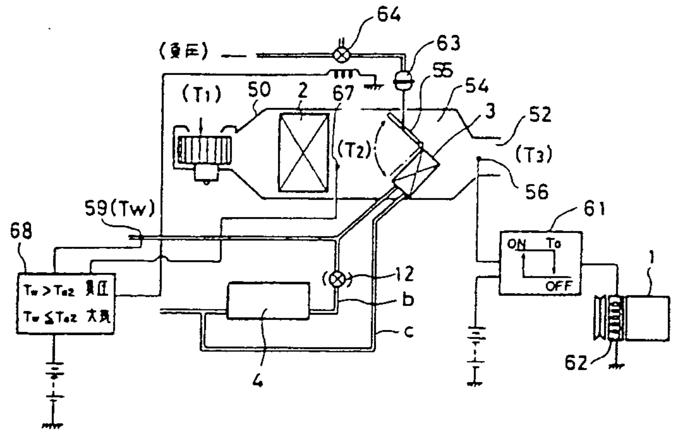

75
72
MAXHOT
MAXCOOL
70
71
73
74
61
56

第5図



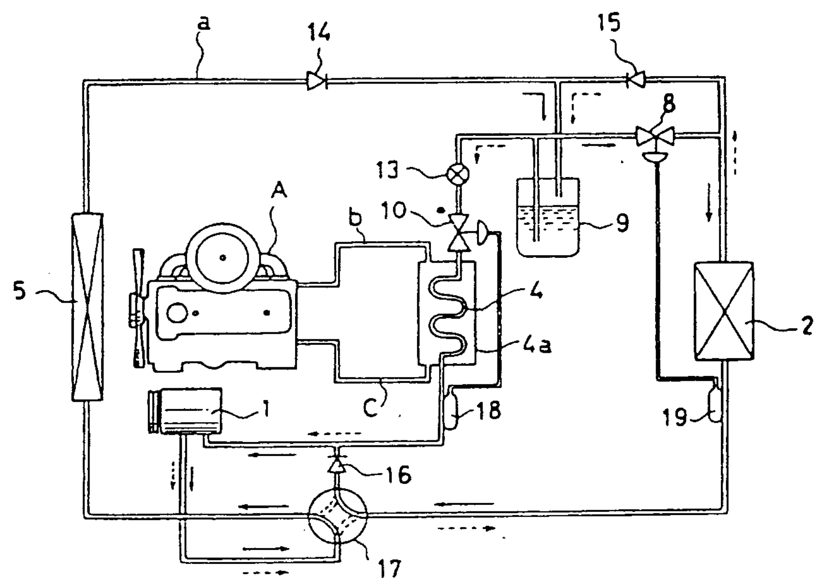
(T1)
51
53
50
2
67
55
54
3
52
(T2)
(T3)
56
59(Tw)
11
61
ON
To
OFF
66
Tw > Tw2 開
Tw ≦ Tw2 閉
12
b
c
4
1
62

第6図



64
(負圧)
63
55
54
(T1)
50
2
67
3
52
(T2)
(T3)
56
59(Tw)
61
ON
To
OFF
68
Tw > Tw2 負圧
Tw ≦ Tw2 大気
12
b
c
4
1
62

第7図



a
14
15
8
13
10
9
A
b
5
4
4a
2
C
1
18
19
16
17

PAT-NO: JP361094811A

DOCUMENT-IDENTIFIER: JP 61094811 A

TITLE: HEAT PUMP TYPE HEATING COOLING DEVICE FOR VEHICLE

PUBN-DATE: May 13, 1986

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APPL-NO: JP59217081

APPL-DATE: October 16, 1984

INT-CL (IPC): B60H001/08, B60H001/00 , B60H001/32

ABSTRACT:

PURPOSE: To enable saving of energy, by actuating a heat pump type cooling heating device so as to supply a defficiency in heating capacity only when temperature lower than an adjustable set air-conditioning temperature is detected by an air temperature sensor through a temperature control means.

CONSTITUTION: An electromagnetic valve 11 for feeding cooling water for an engine to a hot water heater 3 is opened by a control circuit 60 when a cooling

water temperature Tw is higher than a set air-conditioning
temperature
T<SB>0</SB>, a magnet clutch 62 of a compressor 1 is turned
OFF by a control
circuit 61 when a blow-off temperature T<SB>3</SB> is
higher than the
T<SB>0</SB>. When the Tw is lower than a necessary cooling
water temperature
Tw<SB>0</SB> and the heating capacity of the hot water
heater 3 is
insufficient, since a condition of T<SB>3</SB>∼T$0 is
not satisfied, the
clutch 62 is turned ON by the control circuit 61 to start a
heat pump cycle.
This enables operation of a heat pump cycle consuming
energy for driving of the
compressor 1 to be restricted to a minimum.

Japanese Unexamined Patent Application,
First Publication No. Sho 61-94811

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Filing Date:	October 16, 1984
Applicant:	Nihon Denso K.K.
Inventors:	Noriyoshi Miyajima et al.

SPECIFICATION

1. Title of the Invention

Heat Pump Type Cooling and Heating Apparatus for Vehicle

2. Claims

1) A heat pump type cooling and heating apparatus for a vehicle which is of a type used with a hot water heater type heating apparatus with cooling water for an engine as a heat source and utilizing the engine cooling water as a heat source at during a heating cycle, characterized by comprising:

a cool and hot air generating duct containing, in order, between an inlet port for indoor and outdoor air and an outlet port for hot air, a first heat exchanger for said heat pump type cooling and heating apparatus, a second heat exchanger for said hot water heater type heating apparatus, control means for heat exchange ability of the second heat exchanger, and an air blowing fan; an air temperature

sensor for detecting the temperature of air which is blown out of said hot air outlet port; and a circuit for comparing said outlet air temperature detected by the sensor and the set air conditioning temperature and controlling an operation of a compressor for driving said heat pump.

2) The heat pump type cooling and heating apparatus for the vehicle according to claim 1, characterized in that said set air conditioning temperature is adjusted via a variable resistor attached to an operation lever for displacement of the control means for said second heat exchanger.

3. Detailed Description of the Invention

[Technical Field of the Invention]

The present invention relates to a heat pump type cooling and heating apparatus for a vehicle, which is used in combination with a hot water heater type heating apparatus that uses engine cooling water as a heat source.

[Prior Art]

A conventional hot water type heater for an automobile which uses cooling hot water of an engine as a heat source has several problems in the aspect of heating performance. The first one is that it takes much time for cooling water inside a radiator to increase in temperature after the engine is started when outside air temperature is low, that is, the heater lacks a rapid heating ability. The second one is that in the case of a diesel engine vehicle or a recent high-speed gasoline engine vehicle, it is difficult to raise the temperature of the engine cooling water to be sufficiently high to supply heating energy. Such a lack in heating ability becomes a serious problem, especially in

a cold climate area. As a countermeasure, it has been considered to adopt a heat pump type cooling and heating apparatus of a method of working a refrigerating cycle of a vehicle indoor cooling device in the reverse direction to be operated as a heat pump to take in heat from outside air. Although this apparatus is useful as an effective means for enhancing a so-called immediate heating performance, it is desired that the outside temperature be 0°C or higher to obtain a satisfactory sense of warmth, and this cannot be a heater which makes up for the lack in ability of the hot water heater in a cold climate area.

Consequently, the inventors proposed a new heat pump type cooling and heating apparatus with heating ability itself being enhanced in addition to immediate heating performance.

Figure 7 shows a cooling and heating cycle diagram of the above-described apparatus, and is a cooling and heating cycle which is provided with a heat exchanger 4 using cooling water (hot water) of an engine A as a heat absorption source at the time of heating and having a heating decompression device 10 at an upstream side in a refrigerating device constituted by a refrigerant compressor 1, a vehicle outdoor heat exchanger 5, a cooling decompression device 8, a vehicle indoor heat exchanger 2, a receiver 9 and a refrigerant conduit line a which connects the above-descried components as shown in the drawing, and the cooling and heating cycle, which is further provided with a four-way valve 17, an electromagnetic valve 13 that is an opening and closing device for stopping supply of a refrigerant to the heat exchanger 4 at the time of cooling operation, a check valve 14 for preventing supply of the refrigerant to the vehicle outdoor heat exchanger 5 at the time of a heating operation, a check valve

15 for preventing the refrigerant from flowing into the vehicle indoor heat exchanger 2 without going through the cooling decompression device 8 (without going through the receiver 9) at the time of cooling operation, and a check valve 16 for preventing the refrigerant passing through the heat exchanger 4 at the time of the heating operation from flowing into the four-way valve 17, in the aforementioned refrigerant conduit line a to reverse the flow of the refrigerant discharged from the compressor 1 at the time of cooling operation and from that at the time of the heating operation. An operation of the cooling and heating cycle will be explained next.

<1> At the time of a cooling operation

The four-way valve 17 is connected to the refrigerant conduit line a as shown by the solid line in Figure 7, and the refrigerant flows in the direction of the solid line arrow. The refrigerant, which is compressed in the refrigerant compressor 1 and is discharged therefrom, is guided by the four-way valve 17 and enters the vehicle outdoor heat exchanger 5 working as an air cooling type refrigerant condenser at the time of cooling, where the refrigerant is condensed. The condensed refrigerant is stopped by the check valve 15 after passing through the check valve 14, and flows into the receiver 9. The refrigerant is divided into a gas refrigerant and a liquid refrigerant in the receiver 9, and only the liquid refrigerant is discharged from the receiver 9. Since the electromagnetic valve 13 is closed, the discharged liquid refrigerant is adiabatically expanded in the cooling decompression device 8 to be a low temperature refrigerant, then enters the vehicle indoor heat exchanger 2 being a refrigerant evaporator, where the low temperature refrigerant absorbs heat and is evaporated, then passes through the four-way valve 17, passes through the check

valve 16 and is taken into the refrigerant compressor 1 again. The inside of the cabin is cooled by repeating the above-described cycle. The temperature of the heat exchanger 4 at this time is higher than the temperature of the refrigerant flowing into the compressor 1 and the pressure is also high, and therefore the refrigerant inside the heat exchanger 4 flows out to the compressor 1 through the refrigerant conduit line a at the downstream, and only the gas refrigerant remains inside the heat exchanger 4.

<2> At the time of heating operation

The four-way valve 17 connects to the refrigerant conduit line a as shown by the broken line in Figure 7, and the refrigerant flows in the direction of the broken line arrow. The refrigerant compressed in the refrigerant compressor 1 and discharged is guided by the four-way valve 17, enters the vehicle indoor heat exchanger 2 which works as the air cooling type refrigerant condenser at the time of heating, heats the air inside the cabin, and the refrigerant is condensed. The condensed refrigerant is stopped by the check valve 14 after passing through the check valve 15, and flows into the receiver 9 (the cooling decompression device 8 at this time is generally constructed to be closed). The liquid refrigerant discharged from the receiver 9 is decompressed in the heating decompression device 10 and enters the heat exchanger 4 since the electromagnetic valve 13 is opened. Here, the refrigerant absorbs heat of the hot water in a cooling water tank 4a that receives cooling water (hot water) from the engine A via a circulating pipe b and is evaporated, and it is then taken into the refrigerant compressor 1 again, where it is compressed and reaches a high temperature, then it is discharged to the four-way valve 17,

and by repeating the above-described cycle, the inside of the cabin is heated.

[Problems to be Solved by the Invention]

In order to reduce consumption as much as possible of driving energy which is the disadvantage of the heat pump type cooling and heating apparatus superior in heating performance with a method of utilizing engine cooling hot water as described above as a heat source, the present invention uses this apparatus in combination with a conventional hot water heater type heating apparatus, and has as its object to provide an improved heat pump type cooling and heating apparatus for a vehicle capable of automatically working the former apparatus only when the heating ability of the latter becomes insufficient.

[Means for Solving the Problems]

In order to attain the above-described object, a heat pump type cooling and heating apparatus for a vehicle of the present invention is a heat pump type cooling and heating apparatus which is of a type used with a hot water heater type heating apparatus with cooling water for an engine as a heat source and utilizing the engine cooling water as a heat source during a heating cycle, and adopts construction provided with a cool and hot air generating duct containing, in order, between an inlet port for indoor and outdoor air and an outlet port for hot air, a first heat exchanger for the aforesaid heat pump type cooling and heating apparatus, a second heat exchanger for the aforesaid hot water heater type heating apparatus, control means for heat exchange ability of the second heat exchanger, and an air blowing fan; an air temperature sensor for detecting air temperature which is blown out of the aforesaid hot air outlet port; and a circuit for comparing

the aforesaid outlet air temperature detected by the sensor and the set air conditioning temperature and controlling an operation of a compressor for driving the aforesaid heat pump.

[Operation]

The heat pump type cooling and heating apparatus for the vehicle of the present invention including the above-described construction operates the heat-pump type cooling and heating apparatus to compensate for the insufficient heating ability of the aforementioned hot water heater type heating apparatus only when the air temperature sensor provided at the hot air outlet port of the apparatus detects a temperature lower than the set air conditioning temperature adjustable via the temperature control means at the time of heating operation. Starting and stopping of the heat pump is performed through the control circuit for operating the heat pump driving compressor based on the results determined by the comparison circuit of the above-described both temperatures, which is incorporated in the control amplifier of the apparatus.

[Embodiments]

The heat pump type cooling and heating apparatus for a vehicle of the present invention will be explained below based on embodiments shown in the attached drawings.

Figure 1 is an operation cycle diagram of the apparatus, and each component constructing the cycle and the arrangement situation thereof are basically completely the same as those shown in the aforementioned Figure 7 , but differs in the point that a second heat exchanger 3 for a hot water heat cycle is interposed between cooling water circulating pipes b and c connecting a water jacket of an engine A and a heat exchanger 4 in such a manner as to be in parallel with

the heat exchanger 4, and in the point in which an electromagnetic valve 11 for interrupting supply of hot water to the heat exchanger 3 is provided at an upstream side of this second heat exchanger 3. It is preferable to provide a valve 12 for interrupting inflow of the engine cooling water at an upstream side of the heat exchanger 4. The other reference numerals in this drawing are the same as those shown in the aforementioned Figure 7. Reference numerals 18 and 19 denote heat sensing barrels.

Figure 2 is an operation circuit diagram of the apparatus including a schematic sectional side view of a cool and hot air generating duct of the apparatus of the present invention, and reference numeral 50 denotes a hot air generating duct, reference numeral 51 denotes a vehicle inside and outside air inlet port, reference numeral 52 denotes a hot air outlet port, reference numeral 53 denotes an air blower, reference numeral 2 denotes a first heat exchanger for heat pump cycle, reference numeral 3 denotes a hot water heater as a second heat exchanger for hot water heat cycle, reference numeral 54 denotes an air passage for bypassing the second heat exchanger 3, reference numeral 55 denotes an air mix damper as control means for heat exchange ability of the second heat exchanger 3, which selectively seals either an upstream side of the second heat exchanger 3 or the bypass air passage 54, or can selectively adopt an intermediate state of both of these states, and as the control means in place of the damper 55, a remote operation valve, which is interposed in this flow passage for adjusting the hot water inflow amount to the second heat exchanger 3, may be used. Reference numeral 56 denotes an air temperature sensor for the hot air outlet port 52.

Reference numerals b and c are circulating pipes to supply engine cooling hot water to the radiator 4 as a third heat exchanger, and an electromagnetic valve 11 and a valve 12 are interposed in a first half of the pipe. Reference numeral 59 denotes an engine cooling water temperature sensor, reference numeral 60 denotes an open and close control circuit for the electromagnetic valve 11, reference numeral 61 denotes an on-off control circuit for a magnetic clutch 62 for interrupting an engine rotational force to a compressor 1.

Next, an explanation is given of an operation of the above-described apparatus in the case of the maximum heating state in which the air mix damper 55 completely seals the bypass air passage 54 inside the hot air generating duct 50.

If it is assumed that the engine cooling water temperature Tw is sufficiently high now, outlet port temperature T3 of the hot air generating duct 50 which is detected by the hot air outlet port 52 can be made to reach desired set air conditioning temperature To only with use of the hot water heater 3. If the engine cooling water temperature necessary to obtain the outlet air temperature at the temperature To is assumed to be Two, the relational expression of $T3 = To = \phi\ (Two - T1) + T1$ holds with temperature effectiveness of the hot water heater 3 being ϕ and air temperature introduced into the duct 50 being T1, and therefore $Two = 1/\phi\ (To - T1) + T1 = To + (1 - \phi)\ (To - T1)/\phi$ holds, and it is known that the necessary cooling water temperature Two has to be higher than To by ΔT [$= (1 - \phi)\ (To - T1)/\phi > 0$]. For example, when the conditions of $\phi = 0.7$, $T1 = -20°C$, and $To = 50°C$ are set, $Two = 80°C$, and $\Delta T = 30°C$.

The electromagnetic valve 11 for interrupting supply of the engine cooling hot water to the hot water heater 3 is opened when Tw > To,

and closed when $Tw \leq To$ by the open and close control circuit 60. The magnet clutch 62 for interrupting drive of the compressor 1 is set to perform on-operation when $T3 \leq To$, and to be turned off when $T3 > To$ by the on-off control circuit 61. The set air conditioning temperature To can be freely changed by the operation of the adjusting lever as will be described later. Thus, if $Tw \geq Two$, the relation of the valve opening condition of the electromagnetic valve 11, $Tw > To$, holds naturally, and therefore the hot water heat cycle is operated. Since the outlet air temperature T3 is under the condition of $T3 > To$ even if the outside air at the temperature T1 is passed into the hot water heater 3 without being heated by the heat pump heat exchanger 2, the magnet clutch 62 does not perform on-operation, and the heat pump cycle never works.

Next, when $Tw < Two$ holds, that is, when the heating ability of the hot water heater is insufficient, when the outside air at the outside temperature T1 flows into the hot water heater 3 as it is at the same temperature, the condition of $T3 > To$ is not satisfied, and therefore the open and close control circuit 60 makes the magnet clutch 62 perform on-operation to start the heat pump cycle. In this case, as long as Tw is not very low, or is, for example, about 30°C or lower, it is possible to keep the condition of $T3 > To$ only with the heat pump cycle, but as long as the state of $Tw > To$ is kept, the electromagnetic valve 11 is opened, and the hot water heat cycle also functions. The reason of this is that under the state of $Two > Tw > To$, T3 can reach To even if the air temperature T2 of the downstream side of the heat pump heat exchanger 2 is T'o which is lower than To, and from the relationship of $To = \phi\ (Tw - T'o) + T'o$, for example, when $To = 50°C$, and $\phi = 0.7$, if $Tw = 65°C$ ($> To$, $< Two$), $T'o = 15°C$

is sufficient. As Tw is closer to Two, T'o may be a lower temperature, and if T2 > T'o, the state of T3 > To occurs and the on-off control circuit 61 turns off the magnet clutch 62, which results in the heat pump being on-off controlled so that the condition of T2 = T'o is satisfied, accordingly so that T3 = To, that is, the air temperature of the air outlet port 52 is equal to the set air conditioning temperature, thus making it possible to limit the operation of the heat pump cycle which consumes driving energy of the compressor 1 at the minimum necessary amount.

However, when the engine cooling water temperature Tw is further lowered to be lower than the set air conditioning temperature To, the electromagnetic valve 11 is closed based on the instruction from the open and close control circuit 60, which can eliminate the disadvantage that when the air to be heated passes the hot water heater 3, the heat is absorbed by the hot water heater 3 on the contrary. In fact, some unreasonable heat transfer based on the heat capacity of the hot water heater 3 itself is performed for a while when this electromagnetic valve is operated.

The reason why the valve 12 is provided at a midpoint of the hot water pipe connecting the heat exchanger 4 and the hot water heater 3 for the hot water heat cycle is that since the hot water inflow amount to the first heat exchanger 2 is increased and the temperature efficiency ϕ is enhanced by closing the valve 12 when the heat pump cycle is off, Two is sufficient at a comparatively low value, and the effect of availability of the heat pump cycle being reduced by that amount is aimed for and therefore, it is not always necessary to be provided.

Next, explanation proceeds to the case in which the position of the air mix damper 55 for adjusting the outlet air temperature is set at the positions other than the maximum heating (MAX HOT). As for air absorbed from the inside and outside air inlet port 51 of the hot air generating duct 50 and passing through the first heat exchanger 2, the entire amount of the air can be flowed into the hot water heater 3, or the entire amount can be bypassed to the bypass air passage 54, or only part of air can be flowed into the bypass air passage by rotating the air mix damper 55, which is interposed between the first heat exchanger 2 and the hot water heater 3 as the second heat exchanger at the downstream, to an optional position in the range shown by the arrows in the drawing. Now, considering the case in which the damper 55 is in the intermediate position thereof, part of air passing through the first heat exchanger 2 bypasses the hot water heater 3 and goes to the outlet port 52 without being heated, and therefore the heating amount by the hot water heater 3 is reduced as compared with the time when the damper 55 is at the MAX HOT position. In such a state, if the same outlet air temperature as when the damper is in the MAX HOT position is desired to be obtained, it is necessary to satisfy the condition that the engine cooling water temperature Tw be the same as or higher than Two. When this condition is not satisfied, and the heat pump and the hot water heater are used together, the control is carried out so that the heat pump compensates the amount by which the ability of the hot water heater 3 is reduced, and the outlet port temperature is raised to the set air conditioning temperature. Accordingly, a problem is not caused in obtaining desired sense of warmth, but a disadvantage of raising the availability of the heat cycle is uselessly caused. In fact, when the temperature

heat pump + hot water heater used together

is so low that aid of a heat pump is needed, occupants of a vehicle generally set the air mix damper 55 to MAX HOT or a position near it.

Figure 3 is a view of a second embodiment which is an improvement of the first embodiment shown in Figure 2, and a function of eliminating a disadvantage of uneconomical operation when the air mix damper 55 as described above is set in a position other than MAX HOT is included. That is, the circuit setting is performed for a three port electromagnetic valve 64 for operating a negative pressure actuator 63 to displace the air mix damper 55 so that the air mix damper 55 works in the position of MAX COOL under the condition of $To > Two$, and works in the position of MAX HOT under the condition of $To \leq Tw$, based on information from an engine cooling water temperature sensor 59 which is inputted into a control circuit 65. In this case, the air mix damper 55 automatically performs a control of existence and absence of heat exchange in the hot water heater 3, and therefore the electromagnetic valve 11 becomes unnecessary. When it is considered to pass the water to be passed into the hot water heater 3 to the third heat exchanger 4 to improve the heat pump function in the case in which the hot water heater 3 is not worked in the heating cycle shown in the above-described Figure 7, the electromagnetic valve 11 becomes a useful component.

In the above-described embodiment, in the state of single use of the hot water heat cycle, it may happen that the outlet air temperature T3 exceeds the set air conditioning temperature To. It is also possible to include a mechanism to save the trouble of fine tuning of a knob of the air mix damper 55 manually at each time in this case, and this

mechanism functions effectively when only the heat pump cycle is used, or when the hot water heater and the heat pump are used together.

Figure 4 is a construction explanatory view showing the above-described mechanism to keep the set air conditioning temperature To substantially fixed all the time as a third embodiment irrespective of the operation mode of the apparatus of the present invention, and reference numeral 70 denotes an operation lever for the air mix damper 55, reference numeral 71 denotes a rotating shaft of the lever, reference numeral 72 denotes a knob of the lever, an electric contact 73 is attached to the lever 70, and it slides in contact with a variable resistor 74 placed in an arc form around the rotating shaft of the lever. Reference numeral 75 denotes a display panel of the lever position. Both terminal portions of the resistor 74 are connected to the air temperature sensor 56 and the on-off control circuit 61 of the magnet clutch 62, respectively.

The variable resistor 74 has the role of changing the set air conditioning temperature To optionally, and as for the relationship between the position of the lever 70 to vary the resistor value and the set air conditioning temperature, under the outside air temperature and the engine cooling water temperature which become references, the air mix damper position is set according to a certain lever position, and the outlet air temperature obtained when only the hot water heater 3 is worked is determined as the set air conditioning temperature in the set position.

By additionally providing such a mechanism, the outlet port air temperature can be always kept at the set air conditioning temperature To even in the case of an apparatus operation mode other than the heat pump operation time. However, as the outside air temperature

and the engine cooling water temperature are separating from the above-described reference values, a deviation occurs between the outlet temperature and the set temperature in the case with single use of the hot water heat cycle, but the deviation does not become a problem in practical use.

Next, in a fourth embodiment shown in Figure 5, the electromagnetic valve 11 for interrupting supply of hot water to the hot water heater 3 is not opened and closed only based on the variation of the engine cooling water temperature, but the method of comparing the air temperature T2 at the downstream of the first heat exchanger 2 and the engine cooling water temperature Tw, and working the electromagnetic valve 11 in the open position when Tw > T2, and working it in the closed position when Tw ≤ T2 is adopted. Reference numeral 67 is a detecting sensor of the downstream side air temperature T2, and reference numeral 66 denotes a control circuit for opening and closing the electromagnetic valve 11 based on the information from the detecting sensor 67 and the engine cooling water temperature sensor 59.

When the heat pump is of such a type as uses the engine cooling water as a heat source, and is superior in both immediate heating ability at the time of starting the engine and the like and heating ability at the time of normal travel to the conventional heating method depending on only the engine cooling water temperature, as shown in the aforementioned Figure 7, the aforementioned control method does not resultantly differ from the comparison method of the set air conditioning temperature To and the engine cooling water temperature Tw in the first embodiment. This is because until the engine cooling water temperature Tw reaches the set air conditioning temperature

To, the downstream side air temperature T2 of the first heat exchanger 2 as the refrigerant condenser is higher than Tw, then when T2 and To become the same, the magnet clutch 62 for interrupting drive of the compressor 1 performs an on-off operation for the first time, and T2 is kept at the temperature To, and Tw is higher than T2, consequently higher than To.

On the other hand, if the heat pump is of a type which uses potential heat of outside air as a heat source, it is generally inferior to the conventional heating method with single use of hot water in heating ability at the time of normal operation. However, it is superior in the start-up process of the heating function at the time of starting the engine and the like, and in such an apparatus, Tw > T2 holds under the condition of T2 being To or less, and from this point in time, the fourth embodiment which can use the hot water heater is desirable.

Figure 6 is an explanatory view of a fifth embodiment of the apparatus of the present invention, and the idea of the above-described fourth embodiment is realized by borrowing the specific measures of the aforementioned second embodiment.

Reference numeral 63 denotes a negative pressure actuator for rotating the air mix damper 55, reference numeral 64 denotes a three port electromagnetic valve to switch and supply negative pressure or atmospheric pressure to the negative pressure actuator 63, and reference numeral 68 denotes an electronic circuit to control the three port electromagnetic valve 64 based on the information from the engine cooling water temperature sensor 59 and the air temperature sensor 67 at the downstream side of the first heat exchanger 2.

As for the operation, when the engine cooling water temperature Tw exceeds the air temperature T2 at the downstream side of the first

heat exchanger 2 to be Tw > T2, the negative pressure actuator 63 rotates the air mix damper 55 to the direction to release the upstream side of the hot water heater 3 via the work of the three port electromagnetic valve 64 based on the instruction of the electronic circuit 68, and when Tw ≤ T2, it is moved to the closed direction. Interrupting means for supply of hot water to the hot water heater 3 is included in the negative pressure actuator 63 by a known art.

[Effects of the Invention]

The heat pump type cooling and heating apparatus for a vehicle of the present invention is constructed by combining a so-called non-energy consumption type of hot water type heating apparatus which uses only potential heat of the cooling water for preventing overheating of the engine, and an energy consumption type of heat pump type cooling and heating apparatus which needs to be given part of the rotational force of the engine to rotate the compressor for driving the pump, and it is provided with immediate heating ability only when the heating ability of the hot water heater type heating apparatus is insufficient, for example, immediately after the engine is started, and when it is impossible to depend on only this heater which is originally inferior in immediate heating ability, or when it is especially cold, and it is possible to automatically and intermittently operate the heat pump type cooling and heating apparatus which is disadvantageous in the point of energy consumption although it is superior in heating ability at normal time to compensate insufficient indoor temperature (difference between the set air conditioning temperature and the outlet air temperature), thus making it possible to maintain the desired indoor temperature in any circumstances while reducing the consumption amount of the heating energy to the minimum.

4. Brief Description of the Drawings

Figure 1 is an operation cycle diagram of an apparatus of the present invention; Figure 2 is an explanatory view of a first embodiment constituted by a schematic sectional side view of a cooling and heating air generating duct and an operation circuit diagram of the apparatus of the present invention; Figure 3 is an explanatory view of a second embodiment; Figure 4 is a view of a third embodiment showing a mechanism to change the set air conditioning temperature optionally in relation with the opening degree of an air mix damper, Figure 5 and Figure 6 are explanatory views of the fourth embodiment and a fifth embodiment, and Figure 7 is an operation cycle diagram of a conventional heat pump type cooling and heating apparatus for a vehicle.

In the drawings

2 ... First heat exchanger, 3 ... Second heat exchanger (hot water heater), 11, 64 ... Electromagnetic valves, 50 ... Hot air generating duct, 54 ... Bypass air passage, 55 ... Air mix damper, 56, 67 ... Air temperature sensor, 59 ... Engine cooling water temperature sensor, 60, 65, 66, 68 ... Electromagnetic valve control circuit, 61 ... On-off control circuit for magnet clutch 62, 62 ... Magnet clutch for driving a compressor

Figure 1

1 Compressor

2 First heat exchanger

3 Second heat exchanger

Figure 2

#1 Closed

#2 Opened

Figure 3

#1 Negative pressure

#2 Closed

#3 Opened

Figure 5

#1 Opened

#2 Closed

Figure 6

#1 Negative pressure

#2 Negative pressure

#3 Atmosphere

の温水式暖房装置と、ポンプ駆動用コンプレッサを廻すために、エンジンの回転力の一部をゆずり受ける必要のあるエネルギー消費型のヒートポンプ式冷暖房装置を組合せて構成されており、温水ヒータ式暖房装置の暖房能力が不足する時、例えばエンジン始動直後で、元来即効暖房能力に劣るこのヒータのみに頼ることが無理な時とか、特別に寒冷な時にのみ、即効暖房能力を備えており、且つ平常時暖房能力においても勝ってはいるものの、エネルギー消費の点で不利なヒートポンプ式冷暖房装置に、車室内温度不足分（設定空調温度と吹出空気温度との差）を補うべく自動的に間欠作動させることができるので、暖房用エネルギーの消費量を最低限に抑えながら、所望の車室内温度をいかなる状況のもとでも維持させることができる。

4．図面の簡単な説明

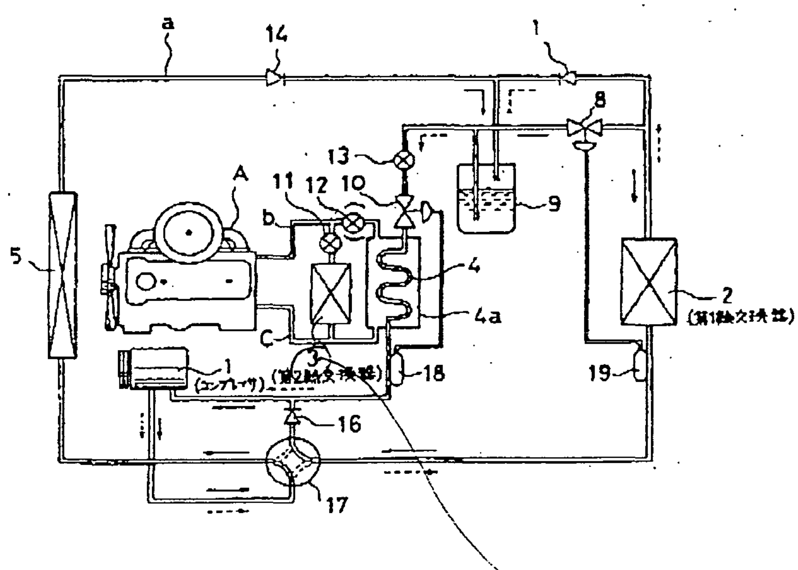
第1図は本発明装置の作動サイクル図、第2図は本発明装置の冷温風発生用ダクトの模式的断面図と装置の作動回路図とからなる第1実施例説明図、第3図は第2実施例の説明図、第4図は設定空調温度をエアミックスダンパの開度との関連において任意に変化させるための機構を示した第3実施例図、第5図および第6図はそれぞれ第4ならびに第5実施例の説明図そして第7図は従来の車両用ヒートポンプ式冷暖房装置の作動サイクル図である。

図中　2…第1熱交換器　3…第2熱交換器（温水ヒータ）、11、64…電磁弁　50…温風発生用ダクト　54…バイパス通気路　55…エアミックスダンパ　56、67…空気温センサ　59…エンジン冷却水温センサ　60、65、66、68…電磁弁制御回路　61…マグネットクラッチ62のオン～オフ制御回路　62…コンプレッサ駆動用マグネットクラッチ

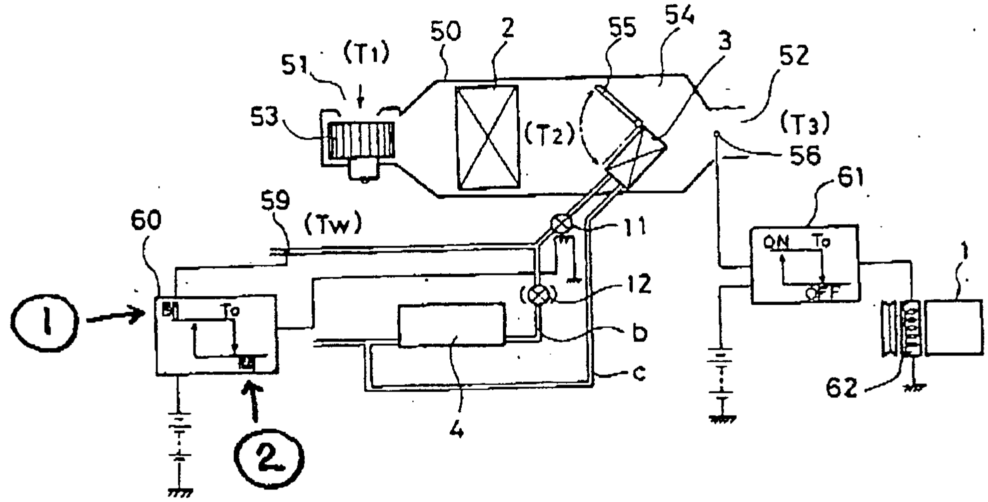
代理人　石黒健二

第1図

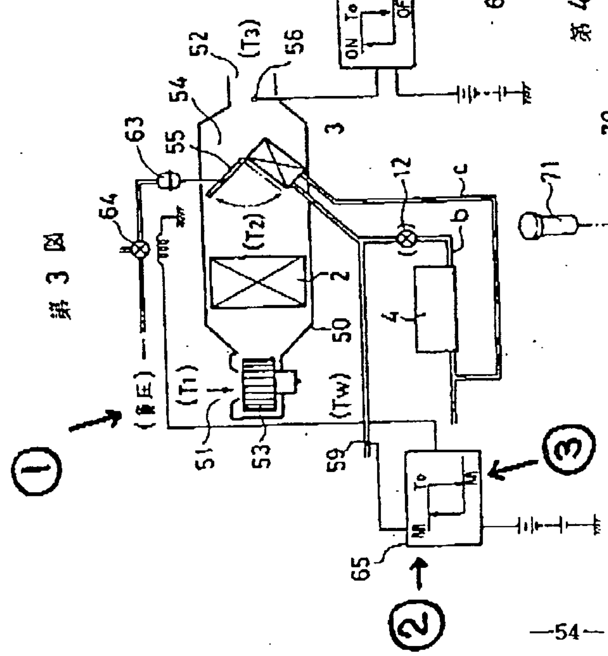
same as prior art Fig 7 except add a coolant HE 3



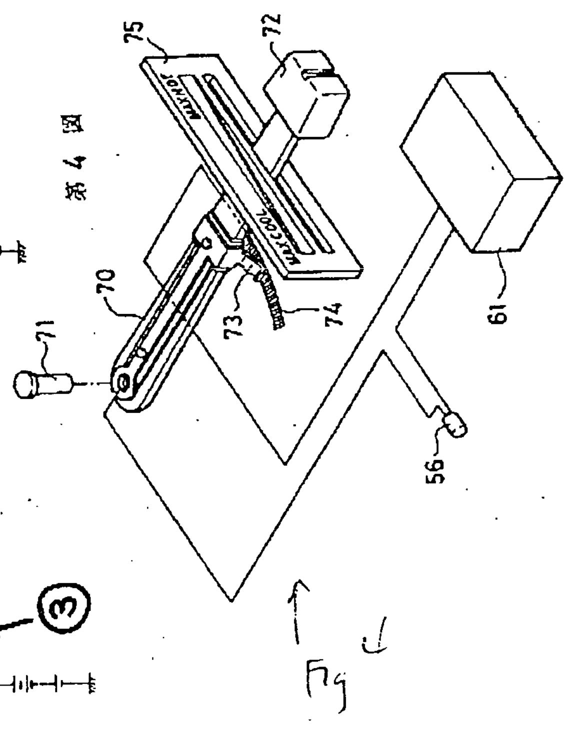
第 2 図



第 3 図

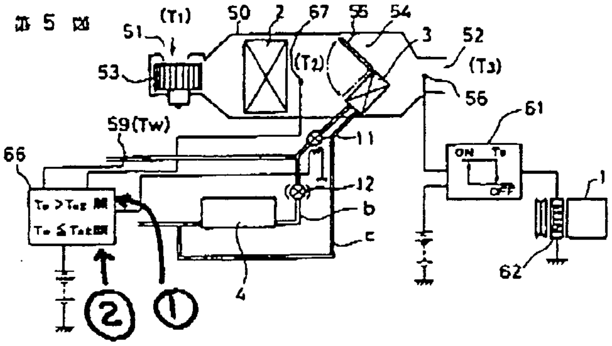


第 4 図

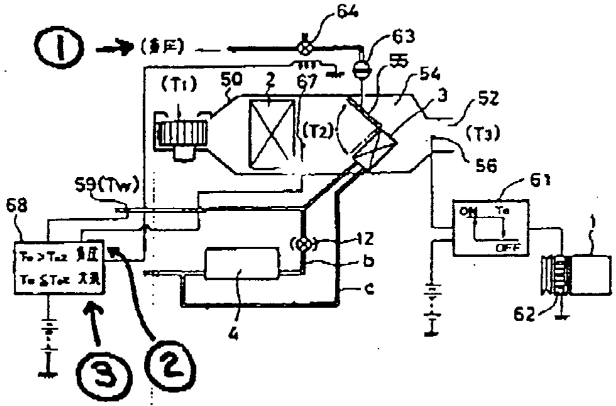


Fig

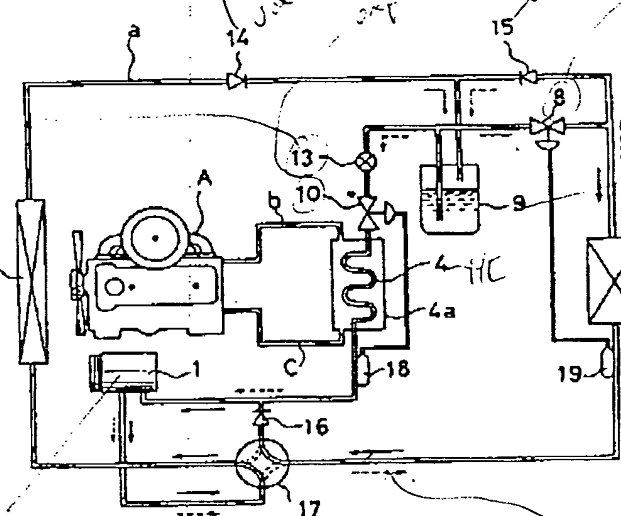
第5図



第6図



第7図



check valve (heating)

expansion valve

check valve

cooling decompression device

13 closing cooling — opening heating

remove

HC

indoor HC

outside HC

compressor

4 way